Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

aSB228
.R43

RESEARCH HIGHLIGHTS

1987-1988

U. S. SUGARCANE FIELD LABORATORY

USDA LIBRARY
ACQ./SERIALS BRANCH
SEP 25 '92

Sugarcane Research Unit

Agricultural Research Service

United States Department of Agriculture

Houma, Louisiana

MISSION AND STAFF

The U.S. Sugarcane Field Laboratory has been conducting research on sugarcane variety development and production practices in the U.S. and Louisiana for over 60 years. The Research Unit has developed numerous CP varieties that have been widely used in the unique subtropical conditions of Louisiana for many years and has produced technology for control of diseases, insects, and weeds that allow these varieties to produce near maximum potential yield. The productivity of the Research Unit has been greatly enhanced by the support of the American Sugar Cane League and the cooperation of the Louisiana Agricultural Experiment Station. The research reported here is a progress report of recent research*. The current USDA-ARS professional staff and the authors of this report are as follows:

PROFESSIONAL STAFF

Rex W. Millhollon
Research Leader/
Research Agronomist

Michael P. Grisham
Research Plant Pathologist

David M. Burner
Research Geneticist

Benjamin L. Legendre
Research Agronomist

John W. Dunckelman
Agronomist

Edward P. Richard, Jr.
Research Agronomist

Hugh P. Fanguy
Research Agronomist

William H. White
Research Entomologist

Donnie D. Garrison
Agronomist

* The data and interpretations in this report may be modified by additional experimentation; therefore, the report should not be published in part or whole without prior approval of the Sugarcane Research Unit, USDA-ARS, Houma, Louisiana and the cooperating agencies and organizations concerned.

BREEDING

__Basic Crosses__. Most Louisiana commercial varieties can be traced to only a relatively few wild relatives. To broaden the genetic base, a basic breeding program was established at Houma in 1972 with several objectives: resistance to diseases - sugarcane mosaic virus, sugarcane smut and ratoon stunting disease; resistance to The sugarcane borer; improved leaf and stalk cold tolerance; and increased cane yield with more ratoon crops and with better adaptation to mechanical harvesting.

As of 1988, 287 candidate varieties from crosses involving 12 new basic breeding lines have been assigned permanent CP (Canal Point) numbers at Houma, with two varieties, CP 82-550 and CP 82-551, being possible candidates for commercial release in 1990. Both varieties are selections from __Saccharum__ __spontaneum__ clone US 56-15-8. An additional 299 clones have been assigned US (United States) breeding numbers and used exclusively in the basic breeding program as the source of new germplasm from crosses involving 27 new basic breeding lines.

Although, the transfer of resistance to sugarcane mosaic virus has been the major success of the basic breeding program, research has shown that a number of the US assignments had the same or greater degree of resistance to brittleness than NCo 310, the most resistant commercial standard. Future crosses involving these clones should provide the basis for commercial varieties with a better adaptability to mechanical harvesting.

To date, nearly 5 million estimated viable seed have been produced in the basic crossing program at Houma from which over 391 thousand seedlings have been set to the field. In 1987/88 over 1 million viable seed were produced with both the number of crosses and the total seed produced setting new records for the facility. **(B.L. Legendre and H.P. Fanguy)**

__Summary of basic breeding program at Houma, LA.__

Breeding series	Seedlings set to field	Established in 1st-line trials	Established in 2nd-line trials	Superior clones receiving permanent assignments US	Superior clones receiving permanent assignments CP
1972-81	243645	12752	1890	251	67
1982	23652	2230	426	31*	12*
1983	16552	792	126	17+	3+
1984	28640	1980	255*	NA++	NA++
1985	29088	1578*	273+	NA++	NA++
1986	28900*	1557+	N24+	NA++	NA++
1987	21166+	NA++	NA++	NA++	NA++
Totals	391643	20891	2970	299	82

* Work completed in 1987; + Work completed in 1988.
++ NA = Data not yet available.

Sugarcane crosses in isolation cubicles of greenhouse.

Early Selection. The early selection phase of the sugarcane breeding program at Houma is divided into four distinct stages: Stage I, seedling (single stool); Stage II, first-line or clonal trial (1 row x 6 ft long); Stage III, second-line or clonal trial (1 row x 17 ft long); and, Stage IV, replicated nursery (2 replications, 1 row x 17 ft). Single stools and first-line trials are advanced to the next stage based on freedom of diseases (mosaic and smut), overall vigor, erectness, stalk characteristics (number, diameter, height and the absence of pith or a hole) and refractometer Brix measured in the field. In the second-line trials and replicated nurseries, laboratory Brix, sucrose and purity are measured from a 10-stalk sample and estimated yield of cane and sugar per acre are calculated based on stalk population per plot, mean stalk weight and theoretical recoverable sugar per ton of cane (TRS).

In total, approximately 100,000 seedlings are planted to the field each year, three-fourths from commercial crosses made at Canal Point, Florida, and one-fourth from basic and special crosses made at Houma, Louisiana. Selection rates in commercial crosses from seedlings through CP assignments have remained stable during the past several years despite the discovery of smut in 1981 and the subsequent susceptibility of many progenies that severely reduced selection rates during the period 1982-1985. All clones including CP assignments selected in 1987 and 1988 from the commercial selection program showed a high degree of field resistance to sugarcane mosaic virus, had a high Brix and were superior in agronomic traits. At the same time that all new CP assignments are planted in the replicated nursery they are also given to the pathologist and entomologist for inclusion in inoculated smut test and sugarcane borer trials, respectively.

Improvements made during the past two years in the early selection program included the conversion from rearing seedlings in soil-filled peat pots in greenhouse culture to the cell-tray method using soilless growing media. This conversion has improved overall efficiency, decreased manpower requirements and increased seedling survival in the field. Another significant improvement was the computerization of all crossing records, to include parents, seed produced, planted and stored as well as records of all plantings, selections, advancements and variety assignments with all pertinent field and laboratory data. **(J.W. Dunckelman and B.L.Legendre)**

Summary of commercial breeding program at Houma, LA.

Breeding series	Seedlings set to field	Established in 1st-line trials	% of seed.	2nd-line trials	% of 1st-line	CP assign.
	(no.)	(no.)	(%)	(no.)	(%)	(no.)
1982	62717	4512	7.1	652	14.5	70*
1983	91274	6369	7.0	874	13.7	84+
1984	77495	5436	7.0	813*	15.0*	NA++
1985	78315	5953*	7.6*	766+	12.9*	NA++
1986	76478*	6583+	8.6+	NA++	NA++	NA++
1987	73963+	NA++	NA++	NA++	NA++	NA++

* Work completed in 1987; + Work completed in 1988.
++ NA = Data not yet available.

Secondary Selection. The secondary selection phase of the sugarcane breeding program at Houma is the infield variety test or Stage V. At this stage, varieties selected for continued testing from the replicated nurseries of both the federal (CP assignments) and state (L and LCP assignments) programs are replanted in replicated yield trials [2 or 3 replications, 3 rows (18 ft) wide x 16 ft long] and of harvested for the first time by mechanical means.

Sugarcane smut continues as one of the primary reasons for discarding new varieties in the replicated infield tests. In 1988 alone, 53% of the varieties dropped from the infield tests had smut listed as one of the main reasons for discarding the variety. A total of 66 CP and 28 L or LCP assignments remained in the infield tests during 1988, all of which exceeded the commercial standards, CP 65-357, CP 70-321 and CP 74-383, in one or more important characters.

In recent years, the standards have been upgraded and candidate varieties must equal or surpass them in weighed yield of cane per acre, sugar per ton, sugar per acre, disease resistance, borer resistance, erectness (adaptability to mechanical harvesting), milling quality (fiber content) and cold tolerance. In the '86 CP series only plant cane yield data are available. Eight varieties yielded at least 10,000 pounds of sugar per acre and 8 varieties yielded better than 290 pounds of theoretical recoverable sugar per ton of cane. Ten of the '85 CP and LCP series clones are still being evaluated. All of these are high yielding varieties, but CP 85-800, CP 85-830, LCP 85-336 and LCP 85-384 have given the highest yields.

Five '84 CP, L and LCP clones, CP 84-730, CP 84-738, CP 84-746, L 84-290 and LCP 84-222 are still in the infield testing program. CP 84-730, CP 84-738 and

CP 84-746 are exceptionally high in sugar per ton. Five clones remaining from the '83 CP and LCP series exceeded the commercial standards in tons cane per acre or sugar per ton. Three clones remaining from the '82 CP and LCP series are candidates for commercial release in 1990. CP 82-550 appears superior in sugar per ton while all 3 of the 182 varieties equalled the commercial standards in sugar per acre in the second stubble crop.

Only 6 varieties (LCP 83-153, CP 84-746, L 84-290, CP 85-830, CP 86-901 and CP 86-961) of the 94 evaluated in 1988 appear to be high in fiber content. Additional testing in both infield and outfield tests is necessary before any of these clones can be recommended for release. **(H.P. Fanguy and B.L. Legendre)**

Outfield Selection. Outfield selection is the final stage (Stage VI) in evaluating candidate sugarcane varieties for release to the Louisiana sugarcane industry. Outfield selection is a cooperative effort between USDA-ARS, the Louisiana Agricultural Experiment Station, and the American Sugar Cane League. The work is conducted in cooperation with sugarcane growers at 14 representative locations within the sugarcane belt of Louisiana. Candidate varieties obtained as a result of secondary selection are tested in replicated plots [3 or 4 replications, 3 rows (18 ft) wide x 32 ft long] in the plant cane, first stubble and second stubble crops on both light and heavy soil.

Varieties in outfield tests in 1988 included CP 83-625, CP 83-644, LCP 83-137, LCP 83-149, LCP 83-153 in the plant cane crop and CP 82-513, CP 82-550, CP 82-551 and LCP 82-89 in the plant cane and first stubble crops. All varieties except LCP 83-137 and CP 82-551 were equal to or higher than CP 70-321, the commercial standard in the yield of sugar per acre. LCP 83-137 and CP 82-551 were lower than CP 70-321 in sugar per acre while LCP 82-89 was higher. CP 82-550 exceeds CP 70-321 in yield of sugar per ton while LCP 82-89 exceeds CP 70-321 in the yield of cane per acre. CP 82-550, CP 82-551 and LCP 82-89 will be considered for commercial release in 1990. All three candidate varieties have shown good field resistance to both sugarcane mosaic virus and smut. **(D.D. Garrison)**

Average yield of sugar per acre in outfield tests in the plant and first-stubble crops on light and heavy soils during 1987/88.

Variety	Sugar per acre: Plant cane*	First-stubble+
	- - - - - - - lb	- - - - - - - -
CP 70-321	7118	6847
CP 82-550	7009	6895
CP 82-551	6718	6826
LCP 82-89	7491	7271

* 24 tests; + 12 tests.

Data on Released Varieties. The variety CP 79-318 was released to the Louisiana sugarcane industry in 1987. Desirable attributes of CP 79-318 are: good yields on both light- and heavy-textured soils, relatively high yield of theoretically recoverable sugar per ton early in the harvest season, moderate fiber content (12.6%), and good juice extraction (80.6%). The variety is moderately erect, but it tends to be brittle and may break when machine harvested for planting or after recent lodging.

CP 79-318 is considered resistant to the spread of sugarcane mosaic virus in the field; however, a high level of mosaic infection can be found in areas of high mosaic incidence. It has adequate resistance to sugarcane smut and is moderately resistant to injury by the sugarcane borer. Early evaluation indicated that CP 79-318 was equal to CP 65-357, the commercial standard, in resistance to post-freeze deterioration of stalks following a light freeze; however, new data obtained in 1988/89 indicated that CP 79-318 may be more susceptible than first reported. **(B.L. Legendre)**

Relative maturity of CP 65-357 and CP 79-318 in the first stubble crop.

Variety	Harvest date	Normal juice: Sucrose	Purity	Theoretical recoverable sugar
		- - - - %	- - -	(lb)
CP 65-357	Oct. 3	9.64	71.01	163.8
	Oct. 17	11.25	76.61	198.9
	Oct. 31	12.08	76.89	214.0
	Nov. 14	13.13	81.36	239.4
	Nov. 28	14.55	84.23	269.5
	Dec. 12	14.65	84.92	272.5
CP 79-318	Oct. 3	10.69	72.39	185.0
	Oct. 17	12.01	77.81	216.2
	Oct. 31	12.35	77.82	222.3
	Nov. 14	14.00	83.25	260.5
	Nov. 28	14.65	84.77	275.0
	Dec. 12	15.07	86.29	285.1

Post-freeze stalk deterioration of CP 65-357 and CP 79-318 in the plant cane crop.

Variety	Days after freeze: 26 F*	26 F+	Theoretical recoverable sugar	Hydrogen ion Conc.	Audity
			(lb)	(pH)	(ml++)
CP 65-357	0		231	5.5	2.0
	66	0	255	5.4	2.4
	86	20	165	5.3	2.8
CP 79-318	0		238	5.4	2.2
	66	0	255	5.3	2.3
	86	20	139	5.0	3.4

* December 18, 1988; + February 24, 1989.
++ ml 0.1 N NaOH per 10 ml juice.

Variety Census. The commercial variety with the largest acreage planted in Louisiana during 1988 was CP 70-321 with 43% followed by CP 65-357 with 25%. Other varieties planted included CP 74-383, CP 72-370, CP 72-356 and CP 76-331 with 10, 9, 5 and 5%, respectively. CP 79-318 is presently being increased by growers. The amount of sugar produced in 1988 was 795,000 tons on 286,000 acres, a new record for Louisiana. **(H.P. Fanguy)**

Screening and Selecting for Borer Resistance. Candidate varieties are evaluated for resistance to the sugarcane borer beginning with the Stage V selections. Data is obtained in a special infield test and at selected outfield locations (Stage VI). Initial evaluations are conducted under artificial infestations with laboratory-reared borer; damage is expressed as percent bored internodes and a damage rating on a scale of 1 to 9 (1 = least damage to 9 = most damage). In the outfield tests, varieties are subjected to natural populations of the sugarcane borer and the damage is expressed as percent bored internodes.

Borer resistance data has been obtained for all varieties of the 1982 through 1985 CP, L and LCP series and for the 1986 CP series. These data are used in the overall evaluation of candidate varieties. Varieties found extremely susceptible to borers are usually discarded. Since 1987, progeny of biparental crosses of sugarcane borer resistant clones, identified in the special infield tests, have been evaluated in the field to determine if a recurrent selection program for borer resistance is feasible.

A small breeding-selection program is also being conducted to evaluate breeding as a technique for improving borer resistance. Seedlings are selected in the plant cane crop, first on the basis of sugarcane borer resistance and second for agronomic type. By using corn as an inoculated host, a heavy but uniform, infestation is assured. A total of 355 seedlings were selected in the fall of 1987 with a selection rate per cross ranging from 0.9 to 12.2%. Each selected seedling was planted in an unreplicated clonal trial (6 ft plot) and evaluated under artificially induced sugarcane borer populations. In the fall of 1988, 41 clones were selected and replanted to a second clonal trial (12 ft plot) for agronomic evaluation and seed increase. Although preliminary, this study suggests that sugarcane borer resistant clones can be effectively identified to be returned to the breeding program for another cycle of recurrent selection.
(W.H. White, J.W. Dunckelman, B.L. Legendre, and H.P. Fanguy)

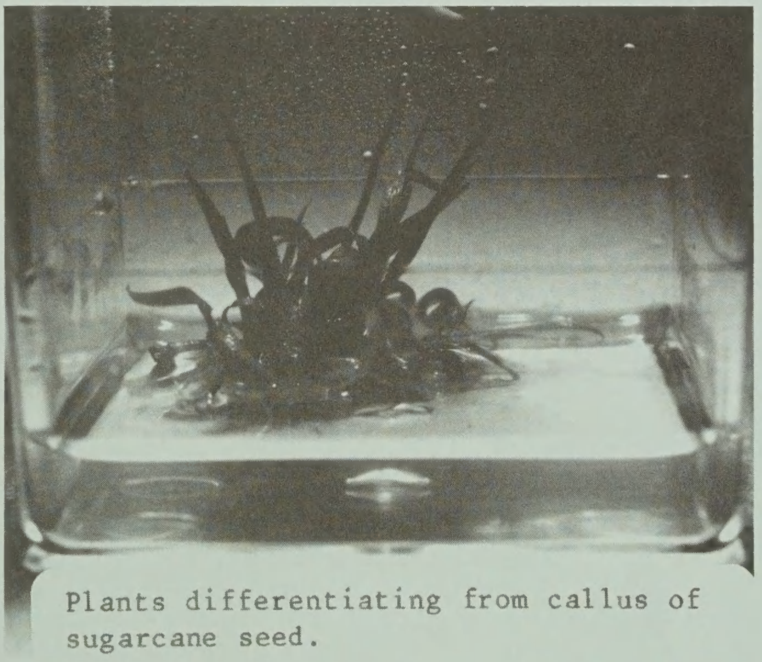
Tissue Culture/Cytology. A tissue culture/cytology laboratory was founded at Houma in 1988 in an effort to better understand and utilize tissue culture in sugarcane improvement and to study the structure, function, multiplication, pathology and life history of the cells of sugarcane and related genera. In one of the first experiments, 150 caryopses (true seed) of each of three commercial varieties was cultured on media containing 2,4-D to induce callus formation. A number of caryopses formed callus and, subsequently, plantlets. Plants derived from individual calli will be evaluated for phenotypic variation.

In a separate study, chromosome pairing was found to be regular in 10 clones of sugarcane and related genera. Depending upon the clone, 66 to 97% of chromosomes paired as ring bivalents while the remaining paired as rod bivalents. Further, it was noted that the chromosome number of several of the clones studied differed from previous reports. **(D.M. Burner)**

Chromosome counts for selected _Erianthus_ (E.), _Eccoilopus_ (Ec.), _Miscanthus_, and _Saccharum_ clones.

Clone	Chromosome number	Species
SES 273	20*	_E. elephantinus_
SES 288	30	_E. elephantinus_
US 64-6-2	38*	_M. sinensis_
SES 189	50	_S. spontaneum_
SES 196	56	_S. spontaneum_
SES 371	60	_E. munja_
US 57-11-2	60*	_Ec. longisetosus_
Coimbatore	64	_S. spontaneum_
SES 114	64*	_S. spontaneum_
Nepal	72*	_S. spontaneum_
SES 521	80	_S. spontaneum_
Tainan	96	_S. spontaneum_
CP 67-353 Variegated	110*	_S. officinarum_ (Comm. hybrid)

* Previously unpublished.



Plants differentiating from callus of sugarcane seed.

PLANT PATHOLOGY

Sugarcane Mosaic. Varieties of sugarcane were found to differ in the amount of yield loss caused by infection with sugarcane mosaic virus (SCMV). Field plots were planted using 0, 50, or 100% SCMV-infected stalks and yields were determined for plant cane, first ratoon, and second ratoon crops. Tonnage and sugar per unit area for the sum of the three crops is given in the table below for seven varieties, six of which are varieties currently recommended for Louisiana. Percent loss varied little between plant cane, first ratoon, and second ratoon crops. Although a large number of initially healthy plants of susceptible varieties became infected with SCMV, the initial level of SCMV-infection remained important in the amount of yield loss observed, illustrating the value of planting clean, disease-free seed.

The strains of SCMV found in Louisiana during the past 10 years were H, I, and M. The distribution of the strains within the three regions of the sugarcane belt was as follows: eastern region (Lafourche Parish) H=96%, I=2%, and M=2%; central region (St. James Parish) H=98%, I=1%, and M=1%; and western region (Iberia Parish) H=82%, I=14%, and M=4%. Strains were identified annually by inoculating differential host plants (sugarcane varieties CP 31-294 and CP 31-588, Rio sweet sorghum, and johnsongrass) with sap from diseased sugarcane plants. The highest incidence of strain I (12-13%) occurred in the western region during 1978-1982. The subsequent decline in incidence of strain I in this region corresponded with phasing-out NCo 310. Strain M appeared intermittently at low levels in all regions; but in 1987 and 1988 in the western region, strain M appeared in 17 and 13%, of the samples, respectively, - most often among samples of the recently released CP 79-318.

Total yields of sugarcane with different levels of initial infection by sugarcane mosaic virus.

	Tons cane/acre			Pounds sugar/acre		
Variety	0*	50	100	0	50	100
CP 52-68	87 a**	79 b	72 b	18451 a	16278 b	14764 b
CP 65-357	106 a	100 a	89 b	24676 a	24509 a	21309 b
CP 70-321	101 a	91 b	90 b	25106 a	22752 b	22735 b
CP 72-356	106 a	98 b	89 b	26607 a	24371 b	22648 b
CP 72-370	95 a	93 a	84 b	25064 a	24682 a	22533 b
CP 72-383	106 a	103 a	89 b	23854 a	23341 a	19472 b
CP 79-318	100 a	93 b	90 b	25081 a	22682 b	21957 b

* Percent initial SCMV-infection.

** Mean of four replicates. Means within varieties with the same letter are not significantly different (P=0.05).

Ratoon Stunting Disease. To determine of the effect of the ratoon stunting disease (RSD) caused by *Clavibacter xyli* subsp. *xyli* on the seven sugarcane varieties currently recommended for commercial planting in Louisiana, yield of disease-infected plants were compared to the yield of uninfected plants in plant cane, first ratoon, and second ratoon crops. Total yields over the three crops, ranged from no detectable loss in CP 79-318 to over 30% in CP 70-321. The greatest yield losses occurred in second ratoon crops. Increasing the planting rate of the RSD-infected sugarcane from approximately 2900, 5-foot stalks per acre to approximately 5800 stalks per acre did not affect the percent loss by RSD over the three crops. **(M.P. Grisham)**

Percent loss of total yield in plant cane, first ratoon and second ratoon crops of commercial sugarcane varieties caused by ratoon disease.

Variety	Cane (%)	Sugar (%)
CP 65-357	14	12
CP 70-321	32	31
CP 72-356	22	18
CP 72-370	18	18
CP 74-383	17	13
CP 76-331	11	10
CP 79-318	0	0

Sugarcane Smut. Candidate varieties of sugarcane are screened for resistance to smut (*Ustilago scitaminea*) by dip inoculating seed cane in a 5 X 10^6 teliospores per ml suspension for 10 minutes prior to planting. The mean percent shoots infected is used to group the candidate varieties into resistant, intermediate, and susceptible classes. Relative frequency of varieties assigned to each class following the 1988 trial is given in the Table. The 86 series of varieties had not been previously screened in an inoculated test. The percentage of varieties in the resistant and intermediate classes among the 85 series and the 79-84 series was increased with moderate selection pressure. **(J.W. Dunckelman and M.P. Grisham)**

Number and percent of CP and L sugarcane varieties assigned to three smut resistance classes.

Series of varieties	Resistant No.	Resistant %	Intermediate No.	Intermediate %	Susceptible No.	Susceptible %
79-84	23	77	6	20	1	3
85	13	57	6	26	4	17
86	12	27	16	36	16	36
Total	48	49	28	29	21	22

ENTOMOLOGY

Control of Sugarcane Borer with Insecticides. Large-plot, aerially-applied insecticide screening trials were conducted in 1987 and 1988 in cooperation with Dr. Dale Pollet, Louisiana Agricultural Extension Specialist. In 1987 two experiments were conducted to compare the standard azinphos-methy (Guthion) treatment at 0.75 lbs ai/acre with the following pyrethroid insecticides: lamda-cyhalothrin (Karate) at 0.025 lbs ai/acre; cyfluthrin (Baythroid) at 0.0285 and 0.033 lbs ai/acre; esfenvalerate (Asana) at 0.033 lbs ai/acre; and esfenvalerate (Asana) at 0.021 lbs ai/acre + acephate (Orthene) at 0.14 lbs ai/acre. Results from the two evaluations showed no significant differences among the insecticides tested, but all insecticide treatments had significantly fewer damaged internodes than the untreated control.

Yellow Sugarcane Aphid. Commercial varieties are being evaluated in the greenhouse for resistance to the yellow sugarcane aphid. Data is being obtained for the three recognized mechanisms of resistance: non-preference, antibiosis, and tolerance. Thus far, only the screening for non-preference has been completed, and results indicate that the varieties CP 72-356, CP 72-370, and CP 76-331 are the most preferred by the yellow sugarcane aphid whereas CP 70-321 is the least preferred. In Louisiana no insecticides are recommended for control of yellow sugarcane aphid, although monocrotophos (Azodrin) is recommended in Florida. With the loss of Azodrin for sugarcane borer control in the 1990 crop and the possibility of yellow sugarcane aphid build-ups following the use of pyrethroids, host-plant resistance may be the only control tactic available to Louisiana sugarcane farmers for managing this aphid. (W.H. White)

JUICE QUALITY

Juice Quality. The juice and milling quality laboratory located at the Ardoyne Farm, Houma, Louisiana, processes from 6-10,000 sugarcane samples each year. User groups include federal, state, industry, cooperator and private scientists. The installation of a prebreaker/hydraulic press in 1987/88, funded by a grant from the American Sugar Cane League, should allow user scientists the opportunity to both qualify and quantify the effects of juice quality (sucrose and purity) and milling quality (fiber content) on the yield of theoretical recoverable sugar per ton of cane (TRS) for any type of sample. The results obtained from this procedure are similar to the core/press analysis.

In an effort to automate the laboratory facility, an electronic scale to measure sample weight and an automatic refractometer and saccharimeter to measure Brix and polarization (pol), respectively, have been interfaced with a desk-top personal computer. Automation of the juice quality laboratory should lead to increased efficiency, minimized error in operation, entry and transcription of data and will provide for a computerized data base in a format ready for statistical analyses.

A special study, in cooperation with Dr. Margaret Clarke, Sugar Processing Research, Inc., with funding provided by the American Sugar Cane League, showed that aluminum chloride/calcium hydroxide can be used as a substitute for lead subacetate as a clarification reagent for polarization analysis of sugarcane juice. Aluminum chloride can be used without loss of precision, reliability or increase in cost of reagents; however, time to prepare and process samples is increased.
(B.L. Legendre)

WEED CONTROL AND CULTURAL PRACTICES

Control of Major Grass Weeds. Several experimental herbicides were evaluated over a 6-yr period as pre-emergence, nonincorporated treatments for control of itchgrass, seedling johnsongrass, and browntop panicum. The three most effective herbicides for the control of all three weeds, without injury to sugarcane, were pendimethalin (Prowl), prodiamine, and cinmethylin (Cinch). In most experiments, these herbicides did not control itchgrass as effectively as soil-incorporated trifluralin, the standard practice, but control generally would be considered adequate for moderate infestations of itchgrass. These herbicides do not control broadleaved weeds effectively and must be mixed with atrazine or other suitable herbicides. The advantage of these treatments is that they do not require soil-incorporation.

Biological Control of Johnsongrass. Loose kernel smut, a disease of johnsongrass and other sorghums, has shown promise as a biocontrol agent in our greenhouse and field studies. This disease causes moderate stunting of plant growth but, most importantly, drastically reduces seed production. Host range studies showed that a relatively high degree of resistance to the disease was present in grain, forage and sweet sorghums with a lower degree of resistance in sudangrasses. Research is being conducted to develop some effective techniques to consistently infest johnsongrass in the field.

Sugarcane Cultivars and Johnsongrass Competition. Studies showed that johnsongrass competition in the plant cane and first-ratoon crops affected growth of 5 sugarcane cultivars by decreasing the number of shoots in spring, number of harvestable stalks, and yield of cane; however, johnsongrass competition increased theoretical recoverable sugar. Under full-season johnsongrass competition in the plant-cane and first-ratoon crops, the cultivars CP 72-370, CP 70-321 and CP 65-357 averaged 31 and 54% reduction in yield of cane, respectively, and as a group were affected less than NCo 310 and CP 48-103 which averaged 48 and 84% reduction, respectively. The results suggest that cultivars that germinate rapidly and that provide abundant tillers in early spring in the plant-cane year are best suited for culture under johnsongrass competition. **(R.W. Millhollon)**

Response of sugarcane cultivars to johnsongrass(JG) competition in plant cane and 1st ratoon.

Cultivar	Sugarcane shoots in June of 1st-ratoon: Weed-free control*	Sugarcane shoots in June of 1st-ratoon: JG infested*	Decrease in sugarcane shoots/ha*	JG greenweight in June of 1st ratoon*
	(no/ha X 1000)		(%)	(t/ha)
CP 72-370	125 a	63 a	50 b	7.8 a
CP 70-321	115 ab	59 a	49 b	8.0 ab
CP 65-357	101 bc	50 ab	50 b	9.3 bc
NCo 310	97 bc	32 b	67 ab	10.2 cd
CP 48-103	90 c	21 b	77 a	11.1 d
Mean	106	45		

* Means followed by the same letter are not significantly different at the .05 level of probability.

Johnsongrass Control with Asulam (Asulox). The response of rhizome johnsongrass and two varieties of sugarcane (CP 70-321 and CP 72-370) to asulam applied broadcast at 3.34 lb ai/a at 2-week intervals beginning on April 1, 1985 and April 15, 1986 (approximately 3 weeks after the last killing frost) was investigated.

Johnsongrass control was similar for all treatment dates in late August with control averaging 69% in CP 70-321 and 56% in CP 72-370. Sequential applications of asulam at 3.0 lb/a, made 8 weeks later, resulted in an additional 15% increase in control in both varieties. When the initial application of asulam was delayed beyond May 1, stalk populations decreased with time, and if left untreated, heavy infestations of johnsongrass caused a 50% reduction in stalk populations of both varieties. Late applications also increased the risk of sugarcane injury, particularly with CP 72-370. Johnsongrass competition and asulam injury had little effect on sugarcane stalk height or juice quality, hence, sugar yields reflected effects on stalk populations. Johnsongrass infestation levels in the spring of the year following treatment were reduced 53% (CP 70-321) and 21% (CP 72-370) where single applications of asulam were used and 72% (CP 70-321) and 55% (CP 72-370) where sequential applications were used.

The responses indicate that timing an asulam application so that johnsongrass "burn-down" coincided with the period of active sugarcane tillering (suckering) was more critical in insuring the maximum production of stalks than the use of sequential applications. However, sequential applications of asulam reduced late season johnsongrass infestation levels and infestation levels in the subsequent crop. Since the degree of johnsongrass control appeared to be less in CP 72-370 than that observed in CP 70-321, the results also suggest that varieties may contribute differently to the level of control obtainable with asulam. **(E.P. Richard, Jr.)**

Row Spacing Studies. The growth and yield of six varieties of sugarcane: CP 65-357, CP 70-321, CP 70-330, CP 72-356, CP 72-370, and CP 74-383, having different growth, stubbling, and harvesting characteristics were evaluated on raised beds spaced 3, 4, and 6 ft apart using culture and harvesting techniques which emulated those used in conventional plantation culture on 6-ft rows.

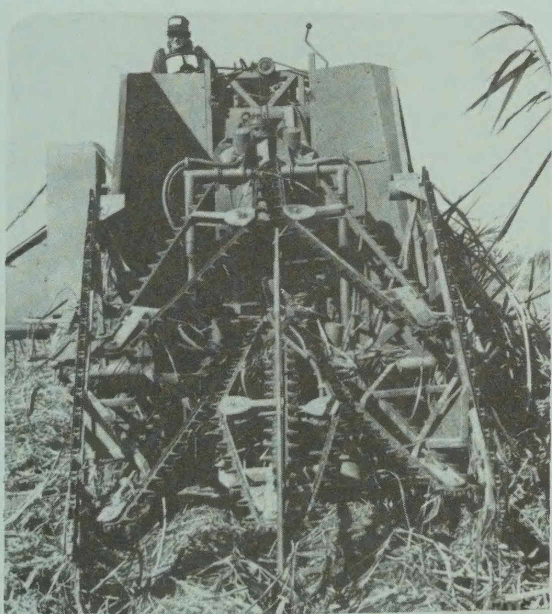
Responses to the narrower row spacings were found to be dependent on crop age and on sugarcane variety. Stalk populations were increased at the narrower spacings, but actual increases did not approach the potential increases based on linear row footage increases of 100% (3 ft) and 50% (4 ft). Stalk populations in the plant cane crop were increased 32% and 17% at the 3- and 4-ft spacings, respectively. Differences decreased with each successive harvest to the point that second stubble stalk populations at the 3- and 4-ft spacings were equivalent and only 7% higher than those of the 6-ft. spacing. When averaged over the entire crop cycle, stalk populations were increased 20% (3 ft) and 15% (4 ft) with the greatest increases occurring in the weaker stubbling varieties, CP 65-357 and CP 70-330. Smaller increases occurred with the better stubbling varieties, CP 70-321, CP 72-356, and CP 74-383.

Stalk weights in the plant cane and first stubble crops averaged 6% lower at the narrower spacings with the greatest reductions occurring in CP 70-330 (11%) and CP 72-370 (8%). The reverse was true in the second stubble crop with the average stalk weights of all varieties being 9% higher at the narrower spacings. When averaged over the 3-yr. crop cycle, stalk weights at all row spacings were similar.

Soldier harvesters, modified to travel in the water furrows of the narrower rows were found to be effective in reducing the stubble destruction observed in earlier studies, but ineffective in harvesting the lodged plant cane and first stubble crops. The greatest problems were associated with topping and removing the extraneous matter. Net cane yields reflected this inefficiency with tonnage being lower than expected based on stalk population and weight.

In the plant cane crop, yields across varieties at the 3- and 4-ft. spacings were equivalent and only 10% higher than the 6-ft. spacing. A natural decline in tonnage was obtained at all spacings after each harvest with the decline being greater at the narrower spacings. By the second stubble crop, yields at the 4- and 6-ft. spacings were equivalent and only slightly less than the 3-ft. spacing. When averaged over the 3-year crop cycle, only the yields of CP 65-357 (6%) and CP 70-330 (12%) were substantially increased. These varieties produced the lowest stalk populations in the stubble crops. Poor tillering may have limited their ability to compensate for the wider area between rows. Harvestability may have also played a role in these increases, particularly CP 65-357.

More efficient utilization of sunlight and nutrients and a more competitive crop with weeds may result from the use of narrow rows. However, the magnitude of the response depends on the growth characteristics of the variety and it harvestability. Use of narrower rows will require the development of a multiple row harvesting and hauling system which can efficiently handle lodged cane with a minimum amount of rutting during wet-weather harvest. Subsurface drainage which maintained the water table level at 4-ft. or deeper did not affect any of the yield components evaluated in this study.
(E.P. Richard, Jr., J.W. Dunckelman and C.E. Carter)


Thompson harvester straddling two 3-ft rows. Note front gathering device, base cutters, and "shredder topper".

GROWTH REGULATORS

Chemical Ripeners. In 1987, the efficacy of a new isopropylamine salt of glyphosate (Polado L) was compared to the standard sodium sesqui salt of glyphosate (Polado). Based on the yield of theoretical recoverable sugar per ton of cane (TRS) no significant differences were found between the two formulations. Increase in the yield of sugar per acre is probable when harvested at the proper treatment-harvest interval i.e. 21-28 days for CP 72-370 and CP 76-331; 28-35 days for CP 65-357, CP 72-356 and CP 74-383 and 35-42 days for CP 70-321. As a result of the 1987 test, the manufacturer introduced the new formulation for the 1988 harvest season. Other changes in the label include the use of "Polado L" on all ratoon crops and allows application in 5 gal spray mixture per acre. Another potential chemical ripener, fluazifop-butyl (Fusilade) is presently being evaluated with possible labelling for the 1989 or 1990 harvest season.
(B.L. Legendre)

Response of sugarcane varieties to two formulations of glyphosate - Polado and Polado L at 0.3 lb/a.

Variety and treatment	Yield of sugar/ton(lb) Treatment-harvest interval (weeks) 0	2	4	6	8	10
CP 65-357						
Control	139	199	251	281	298	319
Polado	---	223	281	310	326	335
Polado L	---	226	270	312	330	324
CP 70-321						
Control	168	217	254	287	305	315
Polado	---	221	284	307	329	335
Polado L	---	223	274	308	333	326
CP 72-356						
Control	157	203	235	264	289	299
Polado	---	216	264	293	313	322
Polado L	---	212	257	291	311	324
CP 72-370						
Control	175	225	256	284	309	321
Polado	---	240	289	303	319	321
Polado L	---	244	313	305	321	319
CP 74-383						
Control	162	198	228	258	287	296
Polado	---	213	272	297	316	324
Polado L	---	215	269	295	318	329
CP 76-331						
Control	166	211	253	286	320	321
Polado	---	231	285	312	335	342
Polado L	---	234	281	308	327	336
LSD .05		12	20	10	9	15

Germination and Tillering Agents. The growth regulator ethephon (Ethrel) was evaluated on several commercial sugarcane varieties both as a seed-piece dip at planting and as a spring foliage treatment. The seed-piece dip generally was more effective and consistent than the foliage treatment in increasing the number of stalks and yield at harvest. The seed-piece dip was particularly effective when used in conjunction with reduced planting rates. In some cases, a 1-stalk planting (single stalks laid end to end in the planting furrow) treated with ethephon produced plant cane yields that were almost equivalent to the standard 2-stalk planting without ethephon. **(R.W. Millhollon and B.L. Legendre)**

1988 Climatic Conditions
Sugarcane Field Laboratory, Houma, Louisiana

	Temperature, °F		Rainfall, in.		No. rainy days	
Month	Mean	Depart.	Total	Depart.	Total	Depart.
Jan.	49.4	- 5.5	3.43	- 0.85	12	+ 4
Feb.	54.2	- 2.7	11.43	+ 7.14	16	+ 8
Mar.	61.0	- 1.5	9.78	+ 5.35	16	+ 8
Apr.	68.5	- 0.1	6.49	+ 2.27	5	- 1
May	72.8	- 1.9	1.88	- 2.62	3	- 4
June	78.3	- 1.6	2.24	- 3.83	11	+ 1
July	80.7	- 0.5	10.05	+ 1.96	18	+ 3
Aug.	81.5	- 0.9	11.88	+ 4.63	19	+ 5
Sept.	78.8	+ 0.4	5.06	- 1.64	11	+ 1
Oct.	67.7	- 2.1	3.52	- 0.23	6	+ 1
Nov.	65.5	+ 4.4	0.97	- 2.86	6	0
Dec.	55.7	+ 0.7	3.15	- 1.77	10	+ 2
Total		-11.3	69.88	+ 7.55	133	+28

PUBLICATIONS and PRESENTATIONS

Benda, G.T.A. 1988. Hot-water cure of sugarcane mosaic in sugarcane stalks in Louisiana. J. Amer. Soc. Sugar Cane Technol. 8:56-61.

Benda, G.T.A, R. G. Mock and A. G. Gillaspie, Jr. 1989. Control of sugarcane mosaic by serial heat treatment II. The pattern of cure at high temperatures. Sugar Cane 2 (March/April):6-10, 16, 19.

Burner, D. M., G. C. Eizenga, R. C. Buckner and P. B. Burrus, Jr. 1989. Meiotic instability of tall fescue-giant amphiploids. Crop Sci. 29: (In Press)

Burner, David M. 1989. Cytology of Saccharum spontaneum clones. S. Branch Am. Soc. Agron. 16:13. (Abstract)

Burner, David M. 1989. An overview of cytological and tissue culture research in wild and cultivated sugarcanes. Sugar y Azucar (Abstract) (In Press)

Clarke, M. and B. L. Legendre. 1989. Replacement of lead salts in polarimetric analysis. Sugar Indust. Tech. Conf. (In Press)

Fanguy, H. P., D. D. Garrison, and B. L. Legendre. 1987. Registration of 'CP 79-318' sugarcane. Crop Sci. (In Press)

Fanguy, H. P. 1988. Performance of the new sugarcane variety CP 79-318 in infield variety tests. Sugar y Azucar 83:6:31.

Fanguy, Hugh P. and Donald B. Fontenot. 1989. The sugarcane variety census for the 1988 Louisiana crop. Sugar Bull. 67:14:10-11, 14-15. and Sugar y Azucar (In Press)

Fanguy, H. P. and D. LeBlanc. 1989. A fencing technique to reduce raccoon feeding damage to sugarcane research plots. Proc. Fourth East. Wildlife Damage Cont. Conf. (Abstract) (In Press)

Fanguy, H. P. and B. L. Legendre. 1989. Evaluation of new sugarcane breeding lines for brittleness. Sugar Cane (In Press)

Grisham, M. P. 1988. Effect of Ustilago scitaminea hyphal placement on infection of in vitro plants. Proc. of Inter. Soc. Sugar Cane Technol. Path. Workshop. Montpellier, France. L'Agronomie· Tropicale:43:160. (Abstract)

Grisham, M. P. 1988. Effect of the rate of planting sugarcane on yield loss from ratoon stunting disease. Phytopathology 78:1530. (Abstract)

Grisham, M. P. and R. D. Breaux. 1988. Effectiveness of screening for smut resistance in the sugarcane selection program in Louisiana. J. Amer. Soc. Sugar Cane Technol. 8:19-22.

Grisham, M. P. 1989. Strains of sugarcane mosaic virus (SCMV) in Louisiana sugarcane. Phytopathology 79:373. (Abstract)

Grisham, M. P. 1989. Potential impact of ratoon stunting disease on recommended sugarcane varieties in Louisiana. Sugar y Azucar and J. Amer. Soc. Sugar Cane Technol. (Abstract) (In Press)

Grisham, M. P., B. L. Legendre, and J. W. Dunckelman. 1989. Independent selection of resistance to Ustilago scitaminea and sugarcane mosaic virus (SCMV) in sugarcane. Phytopatholgoy. (Abstract) (In Press)

Hoy, J. W. and M. P. Grisham. 1988. Spread and increase of sugarcane smut in Louisiana. Phytopathology 78:1371-1376.

Hoy, J. W., M. P. Grisham, and C. P. Chao. 1989. Ustilago scitaminea sorus production and teliospore dissemination and deposition in Louisiana. Phytopathology (Abstract) (In Press)

Jackson, W., H. Waguespack, C. A. Richard, D. D. Garrison and D. Lester. 1989. CP 65-357 Kleentek tests in Louisiana - 1985 through 1988. Sugar y Azucar and J. Amer. Soc. Sugar Cane Technol. (Abstract) (In Press)

Legendre, B. L. 1989. Use of feral germplasm for Cane sugarcane improvement in Louisiana. Proc. Int. Soc. Sugar Tech. 20 (In Press)

Legendre, B. L. 1989. A review of chemical ripening of sugarcane with glyphosate in Louisiana. Sugar y Azucar and J. Amer. Soc. Sugar Cane Technol. (Abstract) (In Press)

Legendre, B. L. and M. Clarke. 1989. Comparison of clarification reagents for polarization analysis of sugarcane juice. Sugar y Azucar and J. Amer. Soc. Sugar Cane Technol. (Abstract) (In Press)

Legendre, B. L. and W. H. Thibaut. 1989. Automation of analyses of sugarcane juice samples. Inter-Amer. Sugar Cane Seminars 9: (In Press)

Millhollon, R. W. 1987. Current status of biological weed control and potential for use in sugarcane. p. 25-35. In "Int. Soc. Sugar Cane Technol. Weed Science Committee Report on Workshop (South Africa)". 55 p.

Millhollon, R. W. 1988. Control of morningglory (Ipomoea coccinea) in sugarcane with lay-by herbicide treatments. J. Amer. Soc. Sugar Cane Technol. 8:62-66.

Millhollon, R. W. 1988. Herbicide treatments having potential for preemergence control of itchgrass, johnsongrass and browntop panicum. Sugar y Azucar 83(6):28. (Abstract)

Millhollon, R. W. 1988. Susceptibility of johnsongrass [Sorghum halepense (L.) Pers.] and [Sorghum bicolor (L.) Moench] cultivars to natural and induced infection with loose kernel smut. Weed Sci. Soc. of America Abstracts 29:62-63.

Millhollon, R. W. 1989. Differential response of sugarcane cultivars to competition from johnsongrass (Sorghum halepense). Proc. Int. Soc. Sugar Cane Tech. 20 (In Press)

Richard, E. P., Jr. and Lynn M. Kitchen. 1988. Control of johnsongrass in fallowed sugarcane fields. J. Am. Soc. Sugar Cane Technol. 8:12-18.

Richard, Edward P., Jr., Joseph F. Yoder, and Lynn M. Kitchen. 1988. Postemergence control of scouringrush (Equisetum hyemale) on sugarcane ditchbanks in south Louisiana. J. Am. Soc. Sugar Cane Technol. 8:44-49.

Richard, E. P., Jr. 1989. Response of selected sugarcane (Saccharum sp.) cultivars to annual applications of preemergence herbicides. Weed Tech. 3 (In Press)

Richard, E. P., Jr. 1989. Effects of asulam application on johnsongrass (Sorghum halepense) control in sugarcane (Saccharum sp.) Weed Tech. 3: (In Press)

Richard, E. P., Jr. 1989. Sugarcane response to soil and foliar applications of metribuzin and terbacil. Proc. South. Weed Sci. Soc. (Abstract) (In Press)

Richard, E. P., Jr. and H. P. Viator. 1989. Crop-herbicide management options for johnsongrass control in fallowed sugarcane fields. J. Am. Soc. Sugar Cane Technol. 9: (In Press)

Richard, E. P., Jr. and H. P. Viator. 1989. Influence of crop-herbicide management on johnsongrass populations in fallowed sugarcane fields. South. Coop. Series Bull. (In Press)

White, W. H. and J. W. Dunckelman. 1988. The response of sugarcane selections to sugarcane borer in the greenhouse and field. J. Amer. Soc. Sugar Cane Technol. (In Press)

White, W. H., J. W. Dunckelman, and B. L. Legendre. 1988. Selection for sugarcane borer resistance in seedling progenies. Sugar y Azucar 83:33. (Abstract)

White, W. H. and H. P. Fanguy. 1988. Evaluating potential sugarcane cultivars by their response to artificially infested sugarcane borer (Lepidoptera: Pyralidae). Field Crops Research. (In Press)

White, W. H. 1989. Resistance mechanisms of Louisiana sugarcane cultivars to the yellow sugarcane aphid. Sugar y Azucar and J Amer. Soc. Sugar Cane Technol. (Abstract) (In Press)

White, W. H., B. L. Legendre, J. W. Dunckelman and H. P. Fanguy. 1989. Screening and breeding for sugarcane borer resistance. Plant Resist. Insect Newsletter. (In Press)